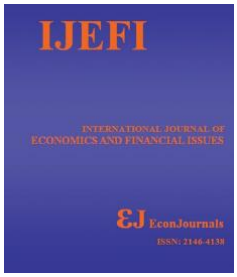

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Innovative Development of Small Entrepreneurship in Ukraine in a Changing Environment

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ABSTRACT

The aim of the study is to assess the impact of innovative development of small businesses in Ukraine on its competitiveness in the context of economic and social changes, as well as to identify factors that affect the effectiveness of innovation strategies in small businesses. The research employed the following methods: Correlation, regression analysis, and analysis of variance (ANOVA). The study established a positive impact of state support on the financial results of enterprises, the correlation between the financial result and the state support level is 0.76. A correlation was also found between the cost of credit resources and financial indicators (correlation coefficient 0.61), as well as a moderate positive relationship between investment in innovation and profitability (0.39). The digitization index (DiGiX) showed a weak impact on the financial result (−0.07), which indicates a significant time for the payback of investment in digitalization. The study covers the period from 2017 to 2024, and it was found that state support and access to credit resources are the main factors determining the success of innovation strategies in small businesses. The results can become the basis for further development of state policies and strategies to stimulate innovation development in Ukraine.

Keywords: Innovative Development, Small Business, Digitalization, Investment in Innovation, State Support
Jel Classification: M1, O31

1. INTRODUCTION

The relevance of the issue under research is the role of innovation as a key factor in business adaptation to economic challenges. Innovation enables small businesses to increase efficiency and reduce costs, respond to market changes and create competitive advantages, especially in the face of economic instability. Small businesses are the basis of the Ukrainian economy, providing over 60% of jobs. According to the State Statistics Service, 1.98 million small businesses operated in 2021, but their number decreased to 1.57 million because of the war. Despite this, about 68% of entrepreneurs are determined to resume their business. Innovation has become an important tool for overcoming crisis phenomena.

The spread of digital technologies and "green" innovations helps businesses to adapt to new conditions. According to estimates by the European Bank for Reconstruction and Development (EBRD) (2024), over 40% of Ukrainian small businesses have switched to digital business models. State support through grant programmes and the development of industrial parks contributes to innovative development. However, there are aspects that require deeper study, in particular the impact of military actions on innovative activity

and the effectiveness of state innovation support programmes. Research on social and green innovations remains relevant.

The aim of the study is to assess the impact of the innovative development of small businesses in Ukraine on their competitiveness in view of economic and social changes, as well as identify factors that affect the effectiveness of innovation strategies in small businesses. The aim was achieved through the fulfilment of the following research objectives:

- Analyse the theoretical foundations of the innovative development of small businesses and identify key concepts;
- Assess the relationships between the innovative activity of enterprises and their competitiveness through correlation, regression analysis and ANOVA;
- Conduct a study of factors that affect the level of innovative activity of small businesses, in particular through DiGiX, investment in innovations, the cost of credit resources, and the level of state support.

2. LITERATURE REVIEW

Innovative development of small businesses is a key factor in ensuring economic stability, especially in the context of digital transformation. Alazzam et al. (2023) investigate information models for e-commerce platforms, focusing on general approaches. However, their study does not take into account the specifics of small businesses in Ukraine, which makes adaptation to local conditions difficult. Skare et al. (2023) had a similar opinion, pointing to barriers to digitalization of small businesses in Eastern Europe, in particular the lack of digital skills and insufficient state support. At the same time, despite the general similarity in the conclusions, Alazzam et al. (2023) focus more on the technological aspect, while Skare et al. (2023) emphasize socio-economic barriers.

Regarding the post-war economic recovery of Ukraine, Kulikov et al. (2022) emphasize the underestimated role of small businesses in this process. At the same time, Shala et al. (2021) analyse innovation strategies for developing countries, emphasizing the importance of digital solutions and flexible business models. These researchers had an opinion similar to Viana Feranita et al. (2020), who argue that state mechanisms for supporting innovation are ineffective without close interaction with the private sector. On the other hand, Shala et al. (2021) focus more on the practical aspects of implementing digital solutions, while Viana Feranita et al. (2020) analyse the overall economic consequences of such measures. Ratten et al. (2019) analyse sustainable innovation in small enterprises, pointing to the economic benefits of using renewable energy sources. Although these ideas have potential for Ukraine, their implementation remains limited. Ghobakhloo et al. (2022) had a similar opinion, emphasizing the financial difficulties and bureaucratic obstacles that prevent small enterprises from effectively integrating innovation strategies. At the same time, research of Ratten et al. (2019) and Singh (2024) focuses more on environmental aspects, while Ghobakhloo et al. (2022) and Prokopenko et al. (2023) focuses on the economic feasibility of sustainable innovations.

Regarding barriers to innovation development, Tyschenko and Shapovalova (2021) had a similar view, pointing to the low level of digital competence as a key problem. At the same time, Shala et al. (2023) focus more on the analysis of the benefits of digital technologies, while Tyschenko and Shapovalova (2021) emphasize the structural problems that complicate their implementation. Da Silva and Cardoso (2024) propose the concept of coopetition as a strategy for the innovative development of small enterprises. However, Kulikov et al. (2022) had the opposite opinion, arguing that innovation clusters are a more effective means of increasing competitiveness. According to Da Silva and Cardoso (2024) and Hervás-Oliver et al. (2021), coopetition can promote the exchange of knowledge and technology, which increases the overall level of innovative activity.

So, the literature review indicates the need for further research on the adaptation of digital technologies, the development of private-public partnerships, and expanding small businesses' access to finance. Despite significant challenges, the use of an integrated approach can contribute to the effective implementation of innovations and increase the competitiveness of small businesses in Ukraine.

3. METHODOLOGY

3.1. Research Design

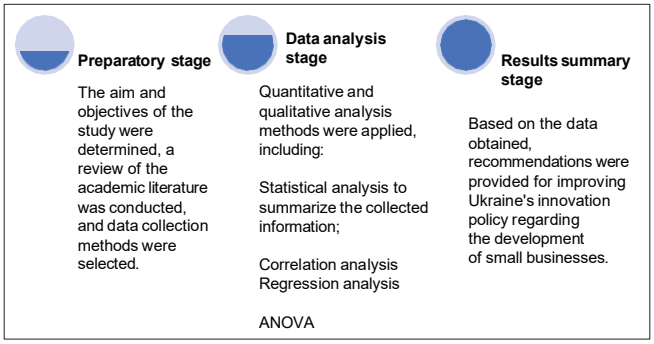
The study of the innovative development of small businesses in Ukraine employed a set of practical methods to deeply assess the processes of innovation implementation and their impact on business competitiveness. The methodology took into account the specifics of Ukrainian small businesses in the context of economic and social changes. The study consisted of several consecutive stages:

The stages of the study are illustrated in Figure 1.

Summarizing the stages shown in Figure 1, they were analysed in more detail:

1. Preparatory stage. This stage included defining the aim and objectives of the study, advancing hypotheses, and determining a conceptual model. An in-depth analysis of academic literature, regulatory legal acts and experience in implementing innovations in small businesses was conducted. Key performance indicators were determined and data collection methods were selected.

Figure 1: Research stages



Source: Developed by the author

2. Data analysis stage. Quantitative and qualitative analysis methods were used to process the collected information: correlation analysis - to determine the strength and direction of the relationship between innovation activity and competitiveness); regression analysis - to identify the factors that most affect innovation development; ANOVA - to compare the effectiveness of different innovation development strategies.
3. Results summary stage. Recommendations were developed to improve innovation policy. Conclusions were drawn regarding the main factors of success and obstacles to the implementation of innovations.

Such a comprehensive approach provided a deep understanding of the processes of innovative development, identifying key trends and factors affecting the activities of small enterprises. It contributed to the development of effective strategies for supporting small businesses, taking into account the specifics of the economic environment and the entrepreneurs' needs. In addition, the obtained results can become the basis for further research and the development of targeted programmes to stimulate innovative activity.

3.2. Methods

Considering the stages of the research design, the first method used is correlation analysis. Its purpose is to identify the presence and nature of the correlation between the variables under study, which can be useful for predicting and modelling various processes. The correlation coefficient (r) is a numerical measure of the strength and direction of the linear relationship between two variables, which ranges from −1 to 1. The Pearson correlation coefficient is the most common measure of the linear relationship between two variables. It is calculated by the formula (Pearson, 1896):

$$r = \frac{\sum (X_i - X)(Y_i - Y)}{\sqrt{\sum (X_i - \bar{X})^2 \sum (Y_i - \bar{Y})^2}} \quad (1)$$

Where X_i and Y_i - values of X and Y variables, respectively;

$\bar{X}$ and $\bar{Y}$ - mean values of X and Y variables, respectively.

The correlation analysis identifies and quantifies the relationships between variables, which is an important step in building models and making informed decisions. The Pearson correlation coefficient is used to determine the relationship between the level of innovation and other variables. Regression analysis assesses the impact of various factors on the innovative development of small businesses in Ukraine. The linear regression model has the form (Huang, 2020):

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \cdots + \beta_n X_n + \varepsilon \quad (2)$$

Where Y - financial result before tax (thousand UAH);
X1 - Digitalization index;
X2 - level of investment in innovation development (million UAH);
X3 - cost of credit resources (average rate, %);
X4 - level of state support for innovation (volume of grants and preferential loans, million UAH);
β_0 - constant (free member of the equation).
$\beta_1, \beta_2 \ldots, \beta_n$ - regression coefficients showing the impact of each factor on the level of innovation development.
ε - random error that takes into account all other unaccounted factors.

Regression analysis assesses the factors influencing the innovative development of small businesses in Ukraine and predict future trends. The results can be used to develop a state policy to support innovative enterprises, financing and access to technologies. ANOVA tests the significance of differences between the mean values of several groups. The study consists of the following stages: advancing hypotheses, calculating the total sum of squares (SST), determining the intergroup (Sum of Squares Between groups, SSB) and intragroup variance (Sum of Squares Within groups, SSW). The last stage is the calculation of the F-test according to the formula (Fisher, 1925):

$$F = \frac{MSB}{MMSW} \quad (3)$$

Where MSB (mean square between) - the root mean square between groups, which measures the variation between group means. It is calculated as (Montgomery and Cahyono, 2022):

$$MSB = \frac{SSB}{dfB} \quad (4)$$

Where SSB - the sum of squares between groups;

dfB - the degrees of freedom between groups.

MSW (mean square within) - within-group mean square, which measures the variation within each group. It is calculated as (Montgomery and Cahyono, 2022):

$$MSW = \frac{SSW}{dfW} \quad (5)$$

Where SSW - the sum of squares within groups;

dfW - the degrees of freedom between groups.

If the resulting value of F exceeds the critical value of the F-distribution for a given significance level ($\alpha = 0.05$), the null hypothesis is rejected, indicating a significant effect of the independent variable on financial performance.

3.3. Sampling

The study is based on the analysis of small business data collected by the State Statistics Service of Ukraine. The sample includes 200 small businesses in Ukraine from 2017 to 2024. The sample includes IT and telecommunications companies engaged in innovative activities or providing services related to digital technologies. According to State Statistics Service of Ukraine

(2024) and KPMG (2024), there are currently 20 thousand small businesses in the IT and telecommunications sector in Ukraine, which became the general population. The main criteria for selecting small businesses were:

1. A small business has been operating for at least 10 years;
2. Has relevant statistical data on development and investment;
3. Positive decisions on providing state grants for the development of innovations.

The key indicators of the analysis are the following indicators: financial result before tax of small enterprises, enterprise DiGiX, level of investment in innovation development, cost of credit resources, level of state support (volume of grants and preferential loans), which are given in Table 1.

The financial result indicator reflects the total income and represents the average profit of a small enterprise. For 2024, the average profit for the sample was ₴0.152 million, which is $3.94 thousand in dollar terms. The DiGiX assesses the level of digital technologies. It is determined in percentages and in 2024 amounted to 40.5% on average. This means that some small enterprises have completely digitized their business processes (by 90-100%). Others remain at the level of 20-30%. The level of investment in the development of innovations demonstrates the average level of investment in research and development (R&D) and is ₴0.063 million on average among the given sample (i.e. $1.62 thousand), which is 21.3% of the total annual income of the enterprise.

The average interest rate is the average value between the offers of state credit programmes and commercial loans. These are short-term liabilities that companies receive as short-term revolving loans. The level of state support is the average indicative state investment in the development of small enterprises, which in the IT and telecommunications industry amounted to ₴1.5 million ($0.039 million) among small enterprises in 2024.

4. RESULTS

A correlation analysis was conducted based on the data presented in the previous section (Table 2). The correlation analysis identifies the relationships between the main economic indicators that affect the financial performance of enterprises. One of the key findings is a strong positive correlation between the financial result before tax and the level of state support, which is 0.76.

This means that enterprises that receive more state support demonstrate higher financial results. There is also a significant positive correlation between financial results and the cost of credit resources (0.61). This may indicate that enterprises with better financial indicators can afford to take out more expensive loans to scale their business or that the cost of borrowed resources affects their profitability. The digitalization index revealed a weak negative correlation with financial results (−0.07), which indicates that at this stage digitalization is not a determining factor of profitability.

At the same time, the DiGiX demonstrates a noticeable negative correlation with the level of investment in innovation development (−0.51). The level of state support shows a very high positive correlation with the cost of credit resources (0.90). This indicates that state funding may be interconnected with lending conditions. Such a relationship may indicate macroeconomic factors, where the state compensates for part of the costs of lending through various incentive mechanisms.

Table 1: Initial data for analysis

Year	DiGiX (%)	Financial result before tax		Level of investment in innovation development		Average interest rate on loans, %	Level of state support,	
		mln. UAH	mln. USD	mln. UAH	mln. USD		mln. UAH	mln. USD
2024	40.5	30.3	0.79	12.5	0.32	14.8	1.5	0.039
2023	36.1	32.9	0.90	15.3	0.42	13.5	2.2	0.060
2022	32.8	37.9	1.26	14.1	0.47	18.2	3.0	0.100
2021	46.2	35.8	1.32	13.7	0.50	17.6	2.8	0.103
2020	42.4	30.7	1.14	12.9	0.48	16.9	2.4	0.089
2019	43.8	34.6	1.34	13.5	0.52	18.7	3.1	0.120
2018	45.2	35.0	1.29	13.4	0.49	19.5	3.3	0.123
2017	46.6	35.4	1.33	13.3	0.50	20.4	3.6	0.135

Source: Developed by the author based on State Statistics Service of Ukraine (2024), KPMG (2024)

Table 2: Correlation matrix

Economic indicators	Financial result before tax, thousand UAH	DiGiX	Level of investment in innovation development	Average interest rate on loans, %	Level of state support, UAH million
Financial result before tax, thousand UAH	1	−0.076272364	0.38491268	0.613941227	0.761651573
DiGiX	−0.076272364	1	−0.517220488	0.529244009	0.38768583
Level of investment in innovation development	0.38491268	−0.517220488	1	−0.329213367	0.096185584
Average interest rate on loans, %	0.613941227	0.529244009	−0.329213367	1	0.902359096
Level of state support, UAH million	0.761651573	0.38768583	0.096185584	0.902359096	1

Source: Developed by the author

Table 3: Results of the regression analysis

Key model metrics		Indicator	Coefficient	P-value
R-squared	0.985	DiGiX	0.127	0.162
Adjusted R-squared	0.965	Investment in innovation	9.6728	0.006
F-statistics	48.94	Cost of credit resources	7.1401	0.006
P-value	0.00459	Government Support	−20.8727	0.010

Source: Developed by the author

The level of investment in innovation development has a weak positive correlation with financial performance (0.39). This indicates that innovative investments can contribute to the growth of enterprise profitability, but this effect is not decisive. At the same time, the level of investment in innovation has a weak negative correlation with the cost of credit resources (−0.32), which may mean that enterprises that invest more in innovation have access to cheaper loans. The high correlation between state support and the cost of credit resources indicates a close relationship between state financial mechanisms and banking policy.

Digitalization and investment in innovation demonstrate a less pronounced impact on financial indicators, although innovative development has a certain positive effect. This indicates that digitalization and innovation can play an important role in the long run, but their direct impact on enterprise profitability is limited without adequate financial support. The next step in the overall research design is the regression analysis, which is presented in Table 3.

The modelling results demonstrate a high explanatory power of the regression model, as the coefficient of determination (R-squared) is 0.985, which means that 98.5% of the variation in the financial result is explained by independent variables. Adjusted R-squared is 0.965, which takes into account the number of predictors and confirms the high quality of the model. The F-statistic value of 48.94 with a P = 0.00459 indicates the statistical significance of the entire model. The analysis of the coefficients shows that the DiGiX has a positive, but statistically insignificant effect (coefficient 0.127, P = 0.162), which may indicate the need for additional factors to assess digitalization.

Investment in innovation turned out to be a significant factor with a coefficient of 9.6728 (P = 0.006), confirming their important role in the financial growth of enterprises. The cost of credit resources showed a positive impact (coefficient 7.1401, P = 0.006), which may be determined by the active attraction of credit funds for business development. At the same time, state support demonstrated a significant negative effect (coefficient −20.8727, P = 0.010), which may indicate the inefficiency of existing programmes or their insufficient adaptation to the needs of small businesses (Figure 2).

The graph shows the relationship between the DiGiX and the financial result before tax. There is a weak positive correlation between these indicators. This may indicate a possible impact of the level of digitalization on the financial performance of small enterprises.

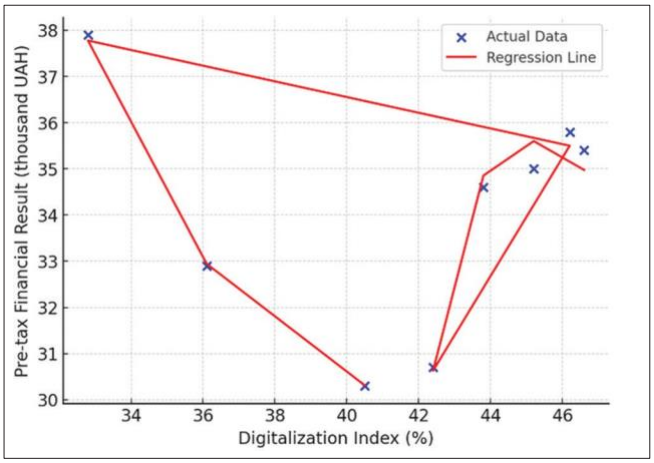
The performed ANOVA quantitatively assesses the impact of various factors on the financial results of small enterprises operating in a dynamic changing environment. Our study

Table 4: Results of the ANOVA calculations

Indicator	F	P-value
DiGiX	14.74	0.0018
Level of investment in innovation development	447.69	5.00e−12
Cost of credit resources	181.04	2.12e−09

Source: Developed by the author
ANOVA: Analysis of variance

Figure 2: Dependence of financial result on the DiGiX



Source: Developed by the author

considered the following key factors: The DiGiX, the level of investment in innovation development, the cost of credit resources, and the level of state support. The data cover the period from 2017 to 2024 and reflect the financial result before tax (thousand UAH) as a dependent variable. The purpose of such analysis is to test the hypothesis that when the level of a factor changes, the average value of financial indicators also changes (Table 4).

The ANOVA results indicate a statistically significant impact of digitalization on the financial results of small businesses. The low P-value (<0.05) suggests that an increase in the DiGiX is associated with better financial performance. Assessing the level of investment in innovation development is one of the most important for the long-term growth and competitiveness of small businesses. The high F-statistics and extremely low P-value indicate that investment in innovation significantly affects financial results. According to the ANOVA results, changes in the interest rate significantly affect the final financial performance.

The highest F-statistics and the lowest P-value among all the studied factors emphasize the special importance of state support in shaping the financial performance of small businesses. State support can take various forms: Investment, preferential loans, tax incentives or special innovation development programmes. The results of the analysis confirm that proper and timely support from the state is one of the most powerful factors in successful innovation activities.

5. DISCUSSION

The results of the study indicate that the key factors determining the financial performance of enterprises are the level of state

support and lending conditions. The strong positive correlation between financial performance and the level of state support, which is 0.76, confirms the conclusions of other researchers on the importance of state mechanisms in supporting small businesses. These results coincide with the conclusions of Hu et al. (2023) and Wang (2023), who note that state subsidies have a significant impact on the efficiency of small businesses. At the same time, high loan rates can be burdensome for small businesses, which supports the idea of the importance of access to cheap financial resources for the innovative development of enterprises (Singh, 2024; Meyer et al., 2021).

An important component of the study is the low correlation between financial performance and the DiGiX (−0.07), which indicates that digitalization does not have a decisive impact on the profitability of small businesses at this stage. This is consistent with the findings of Martínez-Caro et al. (2020), who also note that digitalization, despite its prospects (Agazu and Kero, 2024), may not bring quick financial results, especially in the context of limited resources for small businesses. At the same time, it confirms the findings of Wang (2023), who note that digitalization can have an impact on the long-term sustainability of a business, but not necessarily on short-term profitability (Prasannath et al., 2024).

Regarding investment in innovation, the results of the study show a weak positive relationship with financial results (0.39). This may indicate that innovation contributes to long-term growth, but does not always affect financial performance immediately. These results are consistent with the work of Becerra-Vicario et al. (2023) and Becheikh and Bouaddi (2024), who point to the importance of innovation for the growth of enterprises, but also note that the impact of investment on financial performance may be gradual. A high correlation between the level of government support and the cost of credit resources (0.90) is an important aspect that confirms that government financial mechanisms and credit conditions are interrelated.

This is consistent with the findings of Prasannath et al. (2024), who note that government support can be associated with financing conditions and contribute to reducing financial risks for enterprises (Ameen et al., 2022). The regression analysis conducted in the study also confirms the importance of investment in innovation for the financial growth of enterprises, as noted by Adam and Alarifi (2021), who emphasize that innovation can have a significant impact on the financial results of enterprises (Chen et al., 2023). However, it should be noted that the DiGiX, although showing some positive impact, was not statistically significant, indicating the need for additional research to better understand this impact.

In the context of Ukraine, where small businesses have limited resources, the results of the study indicate the importance of a comprehensive approach to supporting enterprises. This includes not only digitalization and investment in innovation, but also effective financial mechanisms provided by the state. As Olayemi et al. (2022) and Kallmuenzer et al. (2024) showed, state support programmes can significantly improve the financial performance of enterprises undergoing transformation. It is also worth noting that the study of the use of blockchain technologies and smart contracts to automate management processes, conducted by Bannikov et al. (2024) and Trenkle (2020), opens up new opportunities for ensuring the sustainability of small businesses, reducing costs, and increasing the efficiency of operations.

Besides, the concept of start-up projects also confirms the importance of innovation models for small businesses that seek to adapt to rapidly changing economic conditions (Suutari et al., 2023). So, the results of our study are consistent with foreign studies and emphasize that not only technological changes, but also effective public financing and loan conditions are important for the successful innovative development of small businesses.

6. CONCLUSION

The analysis shows that the innovative development of small businesses in Ukraine is influenced by several key factors, the most significant of which are the level of digitalization, the volume of investments, the availability of credit resources, and state support. The level of state support demonstrated the greatest impact on financial results, which indicates the importance of the active role of state institutions in creating a favourable environment for the development of innovations. At the same time, investments in digital solutions and technological modernization remain critical for ensuring the competitiveness of small businesses.

Furthermore, the study confirms the importance of a favourable investment climate, which is a key prerequisite for attracting venture capital and foreign investments in the small business sector. The availability of financial resources plays a decisive role in stimulating innovative activity, therefore, the creation of effective preferential credit programmes can significantly reduce the financial pressure on entrepreneurs. Given the high statistical significance of state support, it is appropriate to develop long-term policies focused on the development of the innovative potential of small businesses. This includes grant programmes, facilitating access to government contracts, advisory assistance, and support for start-ups.

The results of this study may be useful for policymakers, financial sector representatives, and entrepreneurs themselves who seek to adapt their strategies to the modern economic conditions. Limitations of this study include a limited sample of small businesses in Ukraine, which may not reflect the full picture for the entire country. Besides, the study does not take into account external factors, such as the political situation or global economic trends, which may affect the innovative development of small businesses in Ukraine. At the same time, the findings emphasize the need for further research that will cover a broader time and industry context. Expanding the sample and analysing additional factors will allow for a deeper understanding of the mechanisms of innovative development of small businesses and will contribute to the development of even more effective strategies for its support in Ukraine.

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